

Childhood Immunization

Definition: Surveys of school aged children measure retrospectively whether they were appropriately immunized (4 DTP doses, 3 polio doses and 1 MMR dose) by their second birthday. To protect the individual child, as well as diminish the risk to the population at large, a child should also have received 4 Hib doses and 3 Hepatitis B doses by age two.

Summary

Reduction in incidence of vaccine preventable diseases is one of the most significant public health achievements of the past 100 years. Childhood immunization is a widely accepted public health strategy and an indicator of adequate health care. The number of recommended vaccines and total doses has increased in the past five years.

Washington state law requires students to be “appropriately” immunized when they enter school. A combination of public health efforts, the law regarding school entry requirements, and parental compliance have ensured that the majority of school-aged children in Washington state have been adequately protected from vaccine preventable diseases.

A significant proportion of very young children, however, remain under-immunized for the vaccines outlined in the definition above or do not receive immunizations when they should. No information is available on immunization rates for newer vaccines.

The national measles epidemic in 1989-90 emphasized the vulnerability of younger children who were not age appropriately immunized. The greatest gains in protection would come from adequately immunizing children aged two and under.

Time Trends

In Washington state, the immunization rates of school-aged children have remained around 95% over the last few years. However US and Washington immunization rates among children aged two are significantly lower, and well below a year 2000 goal of 90%.

Data of varying reliability that were collected using several different methods suggest that Washington immunization rates among children two years old appeared to improve between 1987 and 1995. However, these trends reflect coverage for DTP, polio, and MMR. There is no information about more recently introduced vaccines (i.e. hemophilus, hepatitis B, second dose MMR, varicella).

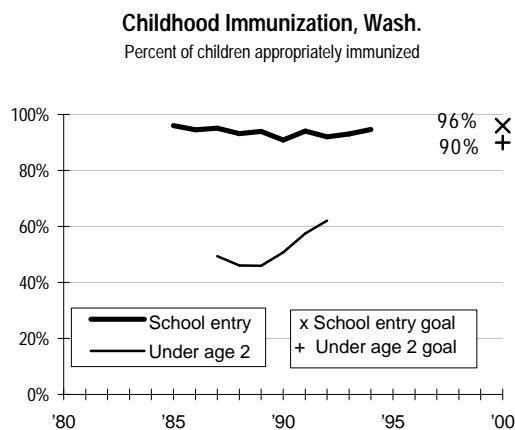
Year 2000 Goal

Washington’s goal is to increase the percentage of school-aged children who are appropriately immunized to at least 96%. Nationally the goal is to have at least 95% appropriately immunized. National data for school-aged children are not available. Currently the rate in Washington is 96.6% \pm 9. The probability of continuing to meet or exceed the state goal is quite high.

Both the National and Washington state goals are to increase the percentage of children two years of age who are appropriately immunized to at least 90 percent.

Historically, data on immunization levels for both 2 year olds and school-aged children have been collected from parents of children as they enter school. However, using these data retrospectively to estimate the immunization status of two-year-olds is problematic. Such data yield rates that do not reflect the vaccination experience of all children; they are two to three years out of date and are based on unverified parental reports and recollections.

To further complicate national and state comparisons, not all states conduct retrospective surveys, and those that do use dissimilar methods.



Among the 42 states with retrospective survey data, immunization rates for 2 year olds in 1988-89 ranged widely, from 17.9% to 100%, with a median of 55.9%. Washington state retrospective survey data collected in 1994 and 1995 indicate that immunization rates in Washington, for children who were two years old in 1991 and 1992 respectively, increased from 57.5% (± 2.4) to 62.1% (± 2.6).

The most current national rates are from a random digit dialing phone survey conducted by CDC in the last three quarters of 1994 and the first quarter of 1995. In that survey, Washington state results indicated that 75% (± 4.2) of children were appropriately immunized by age 2. Because two different survey methods were used, the results between the national random digit dialing survey and the state retrospective survey are not directly comparable. It does appear, however, using the results of either of the surveys, that progress is being made toward Washington's goal of 90 percent immunization rates for children by age 2.

Geographic Variation

Currently the only sub-state data available from the retrospective school surveys are by region. Although the populations of the regions vary greatly, the immunization rates are not significantly different between regions. Data are only available from the last three quarters of 1994 and the first quarter of 1995 from the national random digit dialing survey; these data indicate no significant rate differences between the two regions identified: King county (78% ± 5.3) and the rest of the state (74% ± 5.6).

Race and Ethnicity

There are no race-specific data available in the school retrospective surveys. In the national random digit dialing survey there was no significant difference in pre-school immunization rates between children of white and non-white respondents.

Income and Education

There are no data available on parental income or education in the school retrospective surveys. The national survey indicated no significant differences in immunization rates due to variations in income or education levels.

Other Measures of Impact and Burden

The impact of all vaccine preventable diseases can be quite extensive, but this section is limited to the vaccines listed in the definition for this indicator.

Age Appropriate Immunization Coverage/Delay of Immunizations that are due. Approximately 80% of childhood vaccines are recommended for administration during a child's first two years of life. Even children who are up to date with their vaccines by age two may not have begun the series on time or may not have received vaccinations at the appropriate intervals. Data indicate that the immunizations most likely to be deficient are the fourth DTP and the third oral polio vaccine.^{1,2}

Studies have suggested that the primary cause for measles epidemics is the failure to immunize children at the recommended age. Although measles immunization levels can be as high as 98% at school entry, they have been reported as low as 50% at age two, leaving children susceptible to a disease that is highly contagious and has the capacity to spread rapidly and widely.³

Morbidity. Nationally, because of a measles epidemic, the overall rate for measles infection was 40% higher in 1990 than in 1989, with nearly half of cases occurring in preschoolers. The annual incidence of pertussis rose from .82 per 100,000 in 1982 to 1.72 per 100,000 children in 1986. Infants less than 6 months old had the highest average annual frequency, estimated at 55 cases per 100,000 during the 1982-1986 interval.

In Washington, the incidence rate for measles was .11 per 100,000 in 1992, .00 in 1993, and .09 in 1994. The rate for pertussis was 4.7 per 100,000 in 1992, 1.8 in 1993, and 2.6 in 1994. The age specific incidence for pertussis was highest among children under the age of one.

Costs. National studies published by the National Vaccine Advisory Committee (see data sources) suggest that each 1,000 cases of measles result in \$3-4 million in direct medical costs. Every dollar spent on immunizations for measles, mumps and rubella saves \$10-\$14 in health care costs. Immunization costs in the private sector for providers not using state funded vaccines have increased significantly over the past 10 years due to the addition of new vaccines or additional doses of old vaccines, and are currently estimated at approximately \$300 per full vaccination series. The

cost is lower in Washington state as most immunizations are provided in the private sector with publicly purchased vaccines through universal access to vaccines.

Hospitalization. Pre-school children account for a disproportionate share of all complications reported from measles. The national measles outbreak of 1989-1991 resulted in over 44,000 person/days of hospitalization. In 1993, in Washington state, over 35 percent of reported pertussis cases were hospitalized, resulting in a total of 205 days. The average hospital stay was 5.5 days per case, and the range for hospitalization was from 1-28 days.

Mortality. In the past, mortality due to vaccine preventable diseases was significantly higher. Deaths due to these diseases are now very rare events in the US, except during outbreaks. For example, during the measles epidemic of 1989-1991 over 130 measles-related deaths were reported nationally, with two in Washington state.

From 1992-1994, there were 3 deaths recorded in Washington state related to hepatitis B and one related to Hib. There were no deaths reported for the other vaccine-preventable diseases in that time period.

Risk and Protective Factors

The National Vaccine Advisory Committee has identified four major barriers to immunization in the US.

1) Missed opportunities for administration of vaccines. A missed opportunity is defined as any office visit at which a child does not receive all needed immunizations that could have been safely and appropriately administered. The two most common examples are:

A child is brought to a medical facility for immunization and is not vaccinated because of inappropriate contraindications (i.e. minor illness), or only one of two or more vaccines are given when, in fact, more are needed and should be given.

A child in need of vaccination has contact with a health care provider for other reasons, but immunization status is not assessed and immunizations are not offered.

Most missed opportunities seem to occur during acute visits or health supervision/follow-up visits. Missed opportunities account for half of all under-vaccination.

2) Shortfalls in the health care delivery system. Inadequate resource and restrictive policies may limit access to immunization. Examples include required appointments and physical exams in order to receive immunizations; administration fees; insufficient clinic sites and personnel; inconvenient clinic hours; inefficient record-keeping, tracking and follow-up systems.

3) Inadequate access to care. Generally, studies have shown that preschool children from more affluent families were far more likely to have had a routine health care visit (including preventive services such as immunizations), than children from families with lower incomes.

4) Lack of public awareness and public requests for immunization. In some communities, there is a low demand for immunization and a limited appreciation of the importance of beginning immunizations in infancy among parents who may be isolated from the health care system.

High Risk Groups

Besides barriers that exist in health care settings, a recent literature review conducted in Washington state, found numerous studies reporting that children of these groups of parents are at risk: younger parents; single parents; parents with multiple children; and lower educated parents.

The following groups are also at risk for under-immunization of their children:

The Poor. Low-income mothers are less likely to complete the recommended primary immunization series by seven months.⁴ Poverty is a barrier despite access to free vaccine and few perceived cost barriers by recipients.³ Medicaid or private insurance availability alone does not seem to overcome this cost barrier.¹ Other aspects of poverty, such as lack of reliable transportation, frequent moves, lack of child care, and lack of essential services seem more important than cost.

Those not receiving vaccines due to exemptions. Very few studies have been done regarding exemptions from immunizations and their impact on disease outbreaks. One study suggested that among some children not being vaccinated for pertussis there was inappropriate use of religious and medical exemptions allowed by the state immunization laws.⁵ When children are exempted and adequate follow-up and monitoring are not done with schools and child care facilities with a high level of exemptions (5-10%, according to

CDC), there may be a greater chance of an outbreak occurring.

Intervention Points, Strategies and Effectiveness

Laws. Washington state laws and regulations have been very important in assuring that the majority of school aged children are adequately immunized. Studies done by the CDC in the 1970s involving measles indicated that with adequate availability of vaccines and support from local school administrators and the general public, enforcing school immunization laws can ensure protection of all school children, thereby lowering significantly the potential for epidemics. CDC went on to state that “Enacting and enforcing such comprehensive laws should be given high priority in all public health efforts to control or eliminate measles.”⁶

Financial access. Vaccine costs have been identified as a barrier to immunizations. In recognition of this fact, Washington state implemented a universal vaccine distribution program in 1990, providing vaccines at no cost to any qualified health care provider who requests them through their local health jurisdiction. The goal is to eliminate cost as a barrier, especially through continued governmental support for all recommended vaccines for socioeconomically disadvantaged children.

Immunization tracking, recall, and parent education. Parents rely on providers to monitor immunizations. This seems to work until the toddler years. Parents must be educated about the risks of each disease and the possible side effects of the vaccines, currently recommended vaccines, and the immunization schedule, but several recent studies suggest that parental education alone is insufficient to increase vaccination rates.⁷

Systems that track each child’s immunization status from birth enable both parents and providers to know when immunizations are due. Such systems have shown various levels of effectiveness in improving immunization rates.

CHILD Profile, a health promotion and immunization tracking system for children from birth to age 6, is now being implemented as a pilot in four Washington counties (Island, Kittitas, King, and Snohomish). This system provides computerized tracking and recall for providers, and health education materials for parents. Proper evaluation of

this project should determine its effectiveness in increasing immunization rates.

Public health and provider efforts. Some studies have shown that children who use traditional public health departments or a combination of health department clinics and private services for immunizations are more likely to have experienced delays than those who obtained immunizations from private providers. In other studies, however, aggressive public health strategies have proven effective in raising immunization rates.⁸

There is a need for all immunization providers to assess their immunization practices. The Clinical Assessment Software Application (CASA) program, introduced to all Washington local health jurisdictions, is used to assess immunization status of children in a given medical practice and provide information to providers. According to the CDC, the results of CASA clinic assessments should help improve office immunization practices, and the immunization status of patients. Sufficient studies, however, have not been conducted, nor are they presently being planned, to evaluate this.

Other attempts to increase immunization rates in Washington state have included:

- A provider education program.
- Community-based projects targeted to hard-to-reach children.
- Efforts to increase public awareness about immunizations.

National and state immunization strategies continue to change, but few have been adequately evaluated for their effectiveness. With no national surveillance system for vaccination coverage, and inadequate epidemiological knowledge of effective interventions, it remains difficult to ascertain whether the immunization status of children has increased or maintained. More research is needed to identify and define the factors involved in immunization and non-immunization, and to develop more effective interventions.⁹

Data Sources

State incidence/costs/hospitalization data: Morbidity & Mortality Summary, Washington State Department of Health.

National incidence/costs/hospitalization: HHS Fact Sheet, US Department of Health and Human Services; CDC; National Vaccine Advisory Committee

Annual Communicable Disease Report 1994, Washington State Department of Health

For More Information

Washington State Department of Health
Immunization Program (360) 753-3495

Technical Notes

The annual Washington state school retrospective survey uses a complex survey methodology, following the CDC's 1990 guidelines. Stratified samples of schools from each geographic region are selected using a probability design. Because of this complex design, results are reported using statistical weighting to more appropriately represent state-wide results. Retrospective surveys presently do not take into account the very transient population within Washington state.

The year in which the data are reported reflects the end of the year in which it was gathered, e.g. 1995 data was collected in school year 1994-95.

Endnotes:

¹ "Delays in Childhood Immunization in Public and Private Settings" by William J. Hueston, MD et al, APAM, 5/94.

² "Low Vaccination Levels of US Pre-school and School-aged Children" by ER Zell, et al, JAMA 1994; 271:833-839.

³ "The Measles Epidemic: The Problems, Barriers and Recommendations by The National Vaccine Advisory Committee, JAMA, 9/18/91.

⁴ "Risk Factors for Underimmunization in Poor Urban Infants" by Ann S. Bates, MD. MPH et al, JAMA 10-12-94 Vol. 272 No.14

⁵ "Pertussis Outbreaks in Groups Claiming Religious Exemptions to Vaccinations" by Paul Etkind, MPH et al, AJDC, Vol.146, 2/92.

⁶ "Low Measles Incidence: Association with Enforcement of School Immunization Laws" by Kenneth B. Robbins, MD et al, AJPH 3/81, Vol. 71, No.3.

⁷ "What will it Take to Fully Protect all American Children with Vaccines?" by Alan R. Hinman, MD, MPH, AJDC, Vol.45, 5/91.

⁸ "Childhood Immunization Availability in Primary Care Practices" by William J. Hueston et al, AFM, Vol.3, July 1994; 605-609.

⁹ "Barriers to Vaccinating Pre-School Children by Walter A. Orenstein et al, JHCPU 1990; 1(3): 315-329.